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10. Feb. 2004

14 JUL 2004



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February 2, 2004

European Patent Application No.: PCT/EP02/00598

Applicant: Nokia Corporation

Our ref: WO 32587

(Frist: 3.2. Eing.)

Reference is made to the Written Opinion dated November 3, 2003.

Enclosed new claims 1 to 52 replacing original claims 1 to 38 are filed upon which the further prosecution of the application is to be based.

Furthermore, new description pages 5 to 8 replacing original description pages 5 to 8 are filed upon which the further prosecution of the application is to be based.

The new independent claim 1 being directed to a method of adjusting mobility management is based on original claims 1 and 8. The further amendments included in the last paragraph of claim 1 are based, for example, on description passages at page 9, lines 9 to 15, and page 12, lines 22 to 25. The latter applies also for the new independent claims 15 (being based on original claims 16 and 23) and 29 (being based on original claims 31 and 34). Regarding the objected lack of clarity of original claims 1 and 31, corresponding amendments are introduced in the new claims 1 and 29.

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Kto. 2861 060  
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IBAN-Nr.: DE75 3002 0700 8104 2330 07  
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The respective new dependent claims 2 to 14, 16 to 28 and 30 to 33 are substantially based on the corresponding original dependent claims wherein the wording thereof is adapted to that of the new independent claims 1, 15 and 29.

Furthermore, the new independent claim 34, being directed to a mobility management adjustment system and based on original claim 37, is amended in accordance with point 5.3 of the pending Written Opinion, i.e. the features of new claim 15 are included. Furthermore, new dependent claims 35 to 47 are added which are based on new claims 16 to 28 (in accordance with original dependent claims 17 to 30). Moreover, new dependent claims 48 to 52 are added which are based on original claim 38 and the features defined in new claims 29 to 33 (in accordance with original claims 31 to 36).

The new independent claims 1, 15, 29 and 34 are drafted in the one-part form since a division in the two-part form is deemed to be inappropriate as it would lead to a distorted picture of the invention as the necessary repetition of features would result in an inordinately lengthy and involved claim wording.

In the new description pages 4 to 8, the requested adaptation of the introductory portion to the new statement of claim as well as the introduction of a discussion of the prior art according to references D1 to D3 is effected.

As also acknowledged by the Examiner, document WO 00 38469 A (referred to as reference D1) which represents the closest prior art does not describe the steps of "evaluating" and "adjusting" performed in the "mobility control unit". Hence, the subject matter of claim 1 is

definitely novel. The same applies also for the independent claims 15, 29 and 34 which comprise corresponding features.

However, the subject matter of independent claim 1 (as well as that of the independent claims 15, 29 and 34) does also involve the required inventive step.

According to the present invention timer values of mobility management timers, in particular those of ready timers, RAU timers and/or mobile reachable timers (see also Fig. 5 of the present application) are adjusted to become maximum values or gradually increased timer values in case of an immobile communication unit (M2M, vending machine and the like). This is achieved by sending a specific information element such as a request for a maximum timer value from the "immobile" communication units to a mobility control unit. This specific information element is evaluated by the mobility control unit as a mobility (or immobility) information and used for the reduction of the frequency of the location updates which means that the signalling load of the network is reduced. In other words, the present invention is related to the specific adjustment of the timer values in case of an immobile communication unit.

This subject matter is neither disclosed nor even suggested in reference D1. Even though reference D1 can be deemed to be related to a similar objective problem as the present invention, i.e. reducing the signalling load over the network, the starting point of reference D1 is completely different to that of the present invention. According to reference D1, the signalling load caused by paging (wherein paging is defined to be executed in case of an incoming call for a mobile station (page 2, lines 16 and 17 of D1)) is tried to be reduced by considering a mobility rate of the mobile stations. The mobility rate is determined on the

basis of the frequency of location updating performed by the mobile station (page 5, lines 7 to 10 of D1). For the purpose of reducing the signalling load, a respective registration level (which is called cell-based or location area-based) is defined which is allocated to the mobile stations for pre-selecting the region into which the paging is performed.

However, reference D1 is completely silent about how the frequency of the location updates of the mobile stations can be reduced. In particular, reference D1 does not describe to change timer values in the manner as defined in the present invention. According to page 6, lines 5 to 6, flag and timer information are added by the mobile station, which however are related to the location of the mobile station (page 6, lines 3 and 4 of D1). On the other hand, on page 6, lines 11 to 14, it is described that the mobile station timer is only restarted when a location update is performed or runs until a predetermined time value is reached. However, reference D1 is completely silent about a feature of sending a request for an increased timer value adjustment from the mobile stations to the network or changing the timer value of the mobility management timers on the basis of a information related to the mobility of the mobile station.

Also from the further cited documents WO 99/52306 (referred to as reference D2) and Plassmann D.: "Location management strategies for mobile cellular networks of 3<sup>rd</sup> generation" (referred to as reference D3), a person skilled in the art gets no information which would be of higher relevance for the present invention than that derived from reference D1.

Thus, since the person skilled in the art does not get any hint from the cited prior art leading him in a direction to

execute an evaluation and adjustment as defined in the present invention, he could not be inspired in such a way that the subject matter of the present independent claims 1, 15, 29 and 34 could become obvious to him without requiring an inventive activity.

Therefore, it is respectfully submitted that the claimed invention distinguishes over the prior art and defines patentable subject matter.

Assuming that the amended claims provide at least a basis for an allowable claim version, the Examiner is asked to kindly reconsider his previous opinion in the light of the arguments as presented to file herein above and to correspondingly issue a favourable International Preliminary Examination Report at the next stage of the proceedings.

However, in the case that the Examiner holds a different view regarding the subject matter of the new claim version, a personal consultation with applicant's representative is deemed to be helpful.

Ronald Roth  
Patentanwalt  
**TBK-Patent**

Enclosures:

- New claims 1 to 52
- New description pages 5 to 8

Enclosure of February 2, 2004

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**NEW CLAIMS 1 TO 52**

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1. Method of adjusting mobility management in a mobile  
10 communication network (3; 30; 330), said mobile  
communication network comprising  
a mobility control unit (4; 40; 320) adapted to track  
location of communication units (1; 10; 310) communicating  
in said mobile communication network and to control the  
15 mobility management for said communication units,  
said method comprising the steps of  
providing (S1) said mobility control unit with  
mobility information (M1) related to a communication unit,  
evaluating (S2) the degree of mobility of said  
20 communication unit from said mobility information related  
to said communication unit, and,  
when said step of evaluating indicates the immobility  
of said communication unit, adjusting (S3), by said  
mobility control unit, values of timer elements (15, 45,  
25 16, 46) of said communication unit and said mobility  
control unit to a maximum timer value or a timer value  
being higher than a default timer value of said mobile  
communication network, said timer elements defining a time  
period of a ready state of said communication unit and/or a  
30 time period for performing a location update for said  
communication unit.

2. Method according to claim 1, wherein said mobility  
information related to said communication unit includes a  
35 specific information element indicating a periodic update  
timer value and/or predefined mobility management parameter  
for mobility management elements of said communication unit

and/or said mobility control unit, said periodic update timer value and/or predefined mobility management parameter being detected in said evaluating step.

5 3. Method according to claim 1 or claim 2, wherein said mobility information related to said communication unit includes previous location information and current location information of said communication unit, said previous location information and current location information being  
10 compared in said evaluating step to determine whether they are equal.

4. Method according to any of the preceding claims, wherein said adjusting step comprises a step (S80) of setting said  
15 timer elements of said communication unit and/or said mobility control unit to predefined changed periodic update timer values and/or predefined changed mobility management parameters.

20 5. Method according to any of the preceding claims, further comprising a step of disabling a function of the mobile communication network which is used to force a modification of an operation state of the communication unit.

25 6. Method according to any of the preceding claims, wherein said communication unit is employed in a static device used for a M2M application.

7. Method according to any of the preceding claims, wherein  
30 said mobility control unit is included in a core network control unit of the mobile communication network.

8. Method according to any of the preceding claims, wherein said mobility information related to said communication  
35 unit is provided from said communication unit.

9. Method according to any of the preceding claims, wherein said mobility information related to said communication unit is provided from a core network control unit of the mobile communication network.

10. Method according to claim 8, wherein said mobility information includes a request for setting at least one timer element to a maximum value.

11. Method according to claim 8, wherein said mobility information includes a request for deactivating at least one timer element.

12. Method according to any of the preceding claims, wherein in said adjusting step the timer elements are set to maximum settable values.

13. Method according to any of the claims 1 to 11, wherein in said adjusting step the timer elements are deactivated.

14. Method according to any of the claims 1 to 11, wherein in said adjusting step the timer elements are set to values which are incremented by a predetermined amount in comparison to the values set before (S130; S200).

15. Mobility control unit (4; 40; 320) in a mobile communication network, said mobility control unit being adapted to track location of communication units (1; 10; 310) communicating in said mobile communication network and to control the mobility management for said communication units,

said mobility control unit comprising

means adapted to receive mobility information (M1)

related to a communication unit,

means adapted to evaluate the degree of mobility of said communication unit from said mobility information related to said communication unit, and

means adapted to adjust, when said means adapted to  
5 evaluate indicates the immobility of said communication unit, values of timer elements (15, 45, 16, 46) of said communication unit and said mobility control unit to a maximum timer value or a timer value being higher than a default timer value of said mobile communication network,  
10 said timer elements defining a time period of a ready state of said communication unit and/or a time period for performing a location update for said communication unit.

16. Mobility control unit according to claim 15, wherein  
15 said received mobility information related to said communication unit includes a specific information element indicating a periodic update timer value and/or predefined mobility management parameter for mobility management elements of said communication unit and/or said mobility  
20 control unit, wherein said means adapted to evaluate the degree of mobility of said communication unit detects said periodic update timer value and/or predefined mobility management parameter.

25 17. Mobility control unit according to any of claims 15 to 16, wherein said received mobility information related to said communication unit includes previous location information and current location information of said communication unit; wherein said means adapted to evaluate  
30 the degree of mobility of said communication unit compares said previous location information and current location information to determine whether they are equal.

18. Mobility control unit according to any of claims 15 to  
35 17, wherein said means adapted to adjust said timer

elements sets said timer elements of said communication unit and/or said mobility control unit to predefined changed periodic update timer values and/or predefined changed mobility management parameters.

5

19. Mobility control unit according to any of claims 15 to 18, wherein said mobility control unit is further adapted to disable a function of the mobile communication network which is used to force a modification of an operation state of the communication unit.

10

20. Mobility control unit according to any of claims 15 to 19, wherein said communication unit is employed in a static device used for a M2M application.

15

21. Mobility control unit according to any of claims 15 to 20, wherein said mobility control unit is included in a core network control unit of the mobile communication network.

20

22. Mobility control unit according to any of claims 15 to 21, wherein said mobility information related to said communication unit is received from said communication unit.

25

23. Mobility control unit according to any of claims 15 to 22, wherein said mobility information related to said communication unit is provided from a core network control unit of the mobile communication network.

30

24. Mobility control unit according to claim 22, wherein said mobility information includes a request for setting at least one timer element to a maximum value.

25. Mobility control unit according to claim 22, wherein said mobility information includes a request for deactivating at least one timer element.

5 26. Mobility control unit according to any of claims 15 to 25, wherein said means adapted to adjust the timer elements sets the timer elements to maximum settable values.

10 27. Mobility control unit according to any of claims 15 to 25, wherein said means adapted to adjust the timer elements deactivates the timer elements.

15 28. Mobility control unit according to any of claims 15 to 25, wherein said means adapted to adjust the timer elements sets the timer elements to values which are incremented by a predetermined amount in comparison to the values set before.

20 29. Communication unit (1; 10) used in connection with a mobile communication network (3; 30), said mobile communication network comprising a mobility control unit (4; 40) adapted to track location of communication units communicating in said mobile communication network and to control the mobility management for said communication  
25 units,

said communication unit is adapted  
to send mobility information (M1) related to said communication unit, said mobility information being usable by said mobility control unit to evaluate the degree of  
30 mobility of said communication unit, and

to set values of timer elements (15, 45) of said communication unit to a maximum timer value or a timer value being higher than a default timer value of said mobile communication network, said timer elements defining  
35 a time period of a ready state of said communication unit

and/or a time period for performing a location update for said communication unit, on the basis of predefined changed periodic update timer values and/or predefined changed mobility management parameters received from said mobility control unit in response to the sending of said mobility information.

30. Communication unit according to claim 29, wherein said mobility information related to said communication unit includes a specific information element indicating a periodic update timer value and/or predefined mobility management parameter for mobility management elements of said communication unit and/or said mobility control unit.

31. Communication unit according to any of claims 29 to 30, said communication unit is employed in a static device used for a M2M application.

32. Communication unit according to any of claims 29 to 31, wherein said mobility information includes a request for setting at least one timer element to a maximum value.

33. Communication unit according to any of claims 29 to 31, wherein said mobility information includes a request for deactivating at least one timer element.

34. Mobility management adjustment system used in a mobile communication network (3; 30; 330), said mobility management adjustment system comprises:

a communication unit (1); and  
a mobility control unit (4; 40; 320), said mobility control unit being adapted to track location of communication units (1; 10; 310) communicating in said mobile communication network and to control the mobility management for said communication units,

said mobility control unit comprising  
means adapted to receive mobility information (M1)  
related to a communication unit,

means adapted to evaluate the degree of mobility of  
5 said communication unit from said mobility information  
related to said communication unit, and

means adapted to adjust, when said means adapted to  
evaluate indicates the immobility of said communication  
unit, values of timer elements (15, 45, 16, 46) of said  
10 communication unit and said mobility control unit to a  
maximum timer value or a timer value being higher than a  
default timer value of said mobile communication network,  
said timer elements defining a time period of a ready state  
of said communication unit and/or a time period for  
15 performing a location update for said communication unit.

35. Mobility management adjustment system according to  
claim 34, wherein said received mobility information  
related to said communication unit includes a specific  
20 information element indicating a periodic update timer  
value and/or predefined mobility management parameter for  
mobility management elements of said communication unit  
and/or said mobility control unit, wherein said means  
adapted to evaluate the degree of mobility of said  
25 communication unit detects said periodic update timer value  
and/or predefined mobility management parameter.

36. Mobility management adjustment system according to any  
of claims 34 to 35, wherein said received mobility  
30 information related to said communication unit includes  
previous location information and current location  
information of said communication unit, wherein said means  
adapted to evaluate the degree of mobility of said  
communication unit compares said previous location

information and current location information to determine whether they are equal.

37. Mobility management adjustment system according to any  
5 of claims 34 to 36, wherein said means adapted to adjust  
said timer elements sets said timer elements of said  
communication unit and/or said mobility control unit to  
predefined changed periodic update timer values and/or  
predefined changed mobility management parameters.

10 38. Mobility management adjustment system according to any  
of claims 34 to 37, wherein said mobility control unit is  
further adapted to disable a function of the mobile  
communication network which is used to force a modification  
15 of an operation state of the communication unit.

39. Mobility management adjustment system according to any  
of claims 34 to 38, wherein said communication unit is  
employed in a static device used for a M2M application.

20 40. Mobility management adjustment system according to any  
of claims 34 to 39, wherein said mobility control unit is  
included in a core network control unit of the mobile  
communication network.

25 41. Mobility management adjustment system according to any  
of claims 34 to 40, wherein said mobility information  
related to said communication unit is received from said  
communication unit.

30 42. Mobility management adjustment system according to any  
of claims 34 to 41, wherein said mobility information  
related to said communication unit is provided from a core  
network control unit of the mobile communication network.

35

43. Mobility management adjustment system according to claim 41, wherein said mobility information includes a request for setting at least one timer element to a maximum value.

5

44. Mobility management adjustment system according to claim 41, wherein said mobility information includes a request for deactivating at least one timer element.

10 45. Mobility management adjustment system according to any of claims 34 to 44, wherein said means adapted to adjust the timer elements sets the timer elements to maximum settable values.

15 46. Mobility management adjustment system according to any of claims 34 to 44, wherein said means adapted to adjust the timer elements deactivates the timer elements.

20 47. Mobility control unit according to any of claims 34 to 44, wherein said means adapted to adjust the timer elements sets the timer elements to values which are incremented by a predetermined amount in comparison to the values set before.

25 48. Mobility management adjustment system according to any of claims 34 to 47, wherein said communication unit (1, 10) is adapted

30 to send mobility information related (M1) to said communication unit, said mobility information being usable by said mobility control unit to evaluate the degree of mobility of said communication unit, and

35 to set values of timer elements (15, 45) of said communication unit to a maximum timer value or a timer value being higher than a default timer value of said mobile communication network, said timer elements defining

a time period of a ready state of said communication unit and/or a time period for performing a location update for said communication unit, on the basis of predefined changed periodic update timer values and/or predefined changed

5 mobility management parameters received from said mobility control unit in response to the sending of said mobility information.

49. Mobility management adjustment system according to  
10 claim 48, wherein said mobility information related to said communication unit includes a specific information element indicating a periodic update timer value and/or predefined mobility management parameter for mobility management  
15 elements of said communication unit and/or said mobility control unit.

50. Mobility management adjustment system according to any  
of claims 48 to 49, said communication unit is employed in  
a static device used for a M2M application.

20

51. Mobility management adjustment system according to any  
of claims 48 to 50, wherein said mobility information  
includes a request for setting at least one timer element  
to a maximum value.

25

52. Mobility management adjustment system according to any  
of claims 48 to 49, wherein said mobility information  
includes a request for deactivating at least one timer  
element.

Location Update timer value is currently indicated to the MS in the broadcast information (thus, all MS in same location area use the same value).

- 5 However, when a large number of additional communication units for M2M applications are introduced in the existing mobile communication network structures this will result in an increase in the signaling load for the networks.
- 10 In document WO 00 38469 A an apparatus and a method for providing page messages to mobile radios based on the mobility rates of the mobile radio are described. For mobile radios that are relatively stationary, page messages are sent to a cell in which the mobile radio resides, while radios
- 15 which are increasingly mobile receive their page messages on a local area basis. The mobile radio only performs location updates when the situation is optimized for doing so depending upon the mobility of the radio, the introduction of a new cell, the introduction of a new location area, the
- 20 expiration of a pre-determined time limit and the status of a new cell location flag. A function is defined for location updating on either a locationary basis or a cell basis in accordance with each of the above factors in order to optimize the burden of location area updating and unwanted
- 25 page broadcasting.

- In document WO 99 52306 A a method in the packet switched data transmission between a wireless communication device and a packet network is described, in which data transmission
- 30 between the wireless communication device and the packet network is controlled with at least one packet switching controller (SGSN). A group of connection states is defined in the method, from said connection states one is selected at a given time, and the selected connection state is set to the
- 35 wireless communication device and to the packet switching controller. In addition, said connection states are defined in the method to be: a ready state, in which packets are

transmissible in an activated data transmission connection, a standby state, in which data transmission connection packets to be transmitted and received are waited for, and an idle state, in which the data transmission connection is

5 deactivated. As a connection state also an extended ready state is defined, to which a transition from the ready state is conducted, and in which data transmission connection packets to be transmitted or received are waited for.

10 In "Location management strategies for mobile cellular networks of 3<sup>rd</sup> generation" by D. Plassmann, Vehicular Techn. Conf., 1994, IEEE 44<sup>th</sup> Stockholm, Sweden, 8.10 June 1994, New York, NY, USA, IEEE, 8 June 1994, pages 649-653, XP010123353 ISBN:0-7803-1927-3, several location management strategies  
15 applicable in cellular networks are described. Analytical modelling approaches for signalling cost minimisation are discussed. Results of a GSM based case study are given which are applicable to cellular radio systems of the 3<sup>rd</sup> generation like MBS and UMTS. A hybrid dynamic strategy is  
20 proposed for a public MBS.

#### SUMMARY OF THE INVENTION

It is an object of the present invention to provide an  
25 improved method of adjusting the mobility management in a mobile communication network, and to provide a corresponding system and/or units which improve the mobility management adjustment in the mobile communication network.

30 This object is achieved, for example, by a method of adjusting mobility management according to claim 1.

Furthermore, this object is achieved, for example, by a mobility control unit according to claim 15.

35 Additionally, this object is achieved, for example, by a communication unit according to claim 29.

Furthermore this object is achieved, for example, by a mobility management adjustment system according to claim 34.

Advantageous further developments of the present invention  
5 are as set out in the respective dependent claims.

The mobility information related to said communication unit may include a specific information element indicating a periodic update timer value and/or predefined mobility  
10 management parameter for mobility management elements of said communication unit and/or said mobility control unit, said periodic update timer value and/or predefined mobility management parameter being detected in said evaluating step.

15 Furthermore, said mobility information related to said communication unit may include previous location information and current location information of said communication unit, said previous location information and current location information being compared in said evaluating step to  
20 determine whether they are equal.

In the adjustment, said timer elements (or mobility management elements) of said communication unit and/or said mobility control unit may be set to predefined changed  
25 periodic update timer values and/or predefined changed mobility management parameters.

Furthermore a function of the mobile communication network, which is used to force a modification of an operation state  
30 of the communication unit, may be disabled during the MM adjustment.

The communication unit may be employed in a static device used for a M2M application, such as a vending machine. This  
35 means that the communication unit represents an "immobile mobile station".

The mobility control unit may be integrated in a core network control unit of the mobile communication network. The present invention can be employed in different types of mobile communication networks, such as circuit switched or packet switched networks, 2<sup>nd</sup> or 3<sup>rd</sup> Generation communication networks (GSM, UMTS) and the like. Thus, the core network control unit may be, for example, a mobile switching center (MSC) or a SGSN. However, also other network control elements controlling the MM can be employed.

The timer elements (or mobility management elements) may be timer elements of said communication unit and said mobility control unit, e.g. ready timers, periodic routing area update (RAU) timers or periodic LU timer of said communication unit and/or said mobility control unit (e.g. core network control unit).

The mobility information related to said communication unit may be provided from said communication unit. Furthermore, the mobility information related to said communication unit may be provided from a core network control unit of the mobile communication network.

The mobility information may include a request for setting at least one timer element (or mobility management element) to a maximum value or a request for deactivating at least one mobility management element. Correspondingly, the timer elements (or mobility management elements) may be set to maximum settable values and/or may be deactivated.

Alternatively, the timer elements (or mobility management elements) may be set to values which are incremented by a predetermined amount in comparison to the values set before.